Green Installations, Green Property Management and Green Building Energy Saving

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Sino-Singapore Tianjin Eco-City (SSTEC) is symbolized by its green building constructions. The city also serves as a platform for companies to showcase their green building capabilities. It was bilaterally initiated, invested and developed by the Singapore government and the Chinese government. As a flagship project, the eco-city model is expected to be replicated to meet the long term goal of the Chinese government in pursuing the development of low carbon urban developments to limit carbon dioxide and other greenhouse gas emissions. Featuring benefits such as savings in energy consumption, environmental protection and indoor comfort, green buildings naturally incur higher construction costs. Since SSTEC was in full operation in 2014, both the developers and public authorities would like to know if the benefits of green buildings in the eco-city compensate for and justify the additional construction costs incurred. The answer is critically important as it determines whether green technologies and renewable energy sources can be widely applied at the building, township as well as household levels.

Both the National University of Singapore (NUS) team led by A/P Tu Yong & Prof Deng Yongheng and the SSTEC team led by Ms Wang Ying, have worked together to produce an initial evaluation on the performance of green office buildings owned by the SSTEC. This evaluation report is the first study that depicts the energy-saving effects of green installations and green property management using real building operational data, and it reveals that the greenest building outperforms other types of green buildings in energy consumption reduction, and green property management can substantially raise green buildings' energy efficiency.

The SSTEC has developed and managed four types of green office buildings differentiated by the distinctive green technologies adopted, which consist of 11 building blocks in total. The green installations in the SSTEC office buildings include two categories: 1) energy-saving related green technology installations such as heat recovery system and energy management system; 2) non-energy saving related green technology installations such as CO & CO_2 sensor, outdoor greenery, water-efficient irrigation system and solar power generation, which serve the purposes such as water saving and indoor environment improvement. The construction of the Low Carbon Living Lab (LCLL) also adopts environmentally friendly construction materials such as steel structure and fly ash bricks, which serve the purpose of reducing pollution and prolonging building life.

Among the four types of buildings, the LCLL contains one office building block and claims to be the greenest building in terms of green design and green technologies adopted. The ETP (The Enterprise) and the LM (The Landmark) each contains one office building block, and the RBO (Ready-Built Office) contains 8 office building blocks. Compared to the LCLL, the ETP, LM and RBO employed less green technologies as a whole and focus more on energy saving.

The green property management in the SSTEC innovatively advances the conventional property management strategy through a learning-by-doing procedure. For example, the property management office designs the building operation strategy by following the outdoor weather changes. They set up a new personnel arrangement as well as an incentive/penalty system which requires that the building should be regularly monitored and examined to improve the building performance.

The team finds that the four types of the SSTEC green office buildings are much more energy-efficient using the American green building energy consumption benchmarks and their energy consumption intensity (annual energy use per square meter) are below the benchmarks of China cold area green building energy consumption. We note that this could also be due to the lower occupancy rates in the SSTEC office buildings.

Accrued benefits of green buildings include not only savings in energy consumption, but also environmental protection and indoor comfort. Due to the short data span and low building occupancy rate, the present work cannot directly demonstrate the relationship between the building energy consumption and the green technologies adopted. However, we find that green property management can substantially improve green buildings' energy efficiency and the impact is stronger for greener buildings. Although higher green cost (higher intensity of green installations) does not necessarily lead to lower energy consumption in a green building, green property management can effectively tap the existing potential of green benefits arising from green technologies.

We have also found that the LCLL which claims to be the greenest office building in the SSTEC, in general, outperforms other types of green buildings in energy consumption reduction. Green property management effectively reduces energy consumption in outdoor/indoor lighting, fan system motor and water pump for air-conditioners in the LCLL. In addition, since it adopts green design and other types of green technologies, it should provide the most comfortable working environment.

Looking ahead, with the Tianjin Eco-city gradually moving towards its full occupancy in the years to come and more data becoming available, it is necessary to continuously conduct cost-benefit analyses from the aspects of green property management, green behaviors and green governance. This would better justify if the benefits of green buildings in the eco-city do indeed compensate for the additional construction costs incurred.